



QUICK REVISION MODULE (UPSC PRELIMS 2022) GEOGRAPHY INDIAN CLIMATE



INDIAN CLIMATE



THE TROPICAL MONSOON TYPE CLIMATE

Salient Features of Indian Climate



Unity of Indian Climate

Himalaya act as a climatic divide. Prevents cold wind from Central Asia. Even parts North of Tropic of Cancer experiences Tropical Climate



Reversal of Wind

In Winter: Dry wind blows from North-East to South-West

In Summer: Wind reverses its direction completely and blows from South-West to North-East.



Alternative High and Low Pressures:

In Winter: High Pressure due to cold conditions in North India

In Summer: Thermally induced low Pressure cells over North-Western India



Seasonal and Variable Rainfall

80% of annual rainfall in latter part of summer (1-5 months)



Plurality of Seasons

Winter, Fall, Spring, Summer, Rain, Autumn.



FACTORS DETERMINING CLIMATE OF INDIA



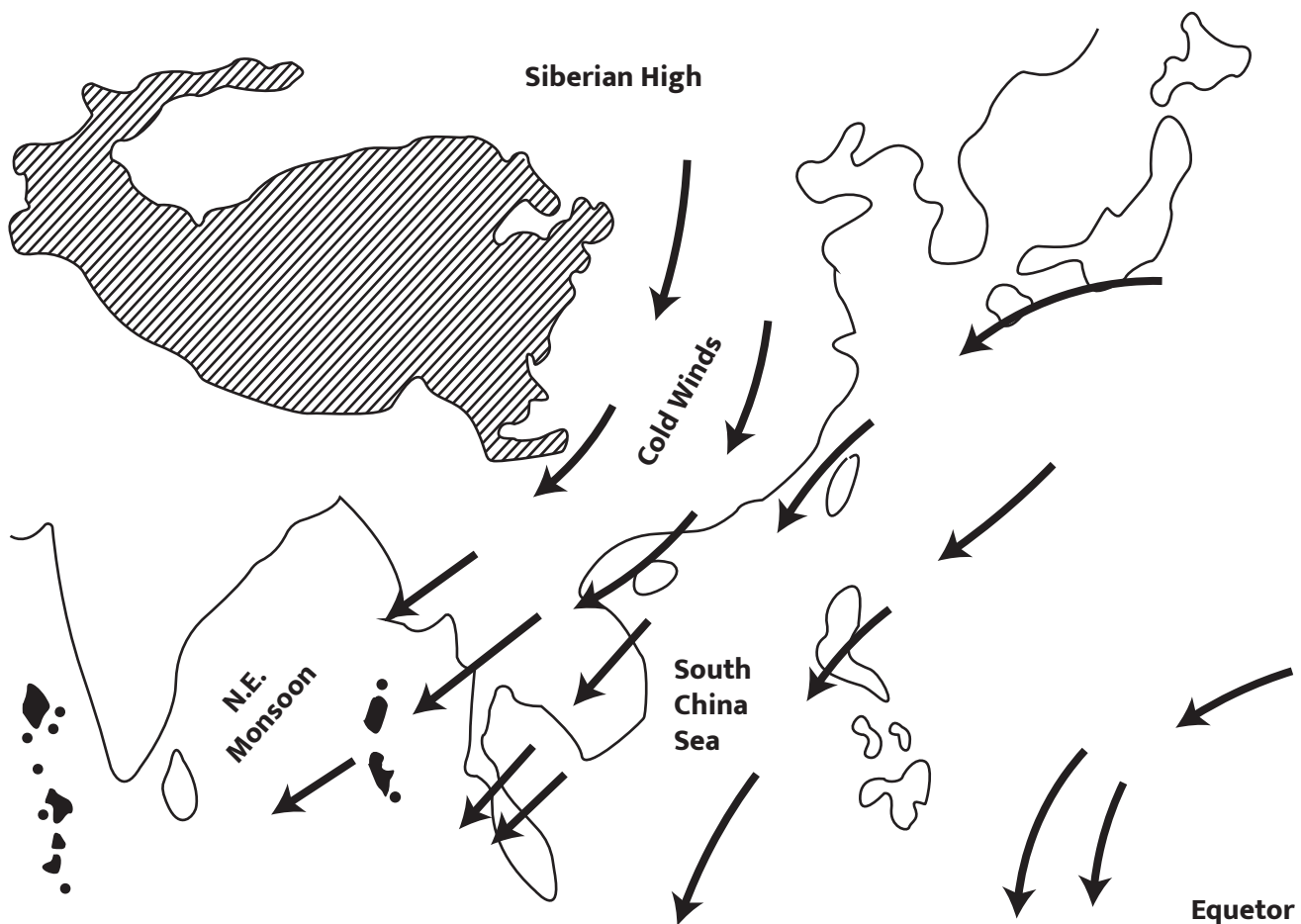
Factors Related to Air Pressure and Wind

DISTRIBUTION OF PRESSURE AND SURFACE WINDS



WINTER

Dry continental air mass moving from Central and West Asia towards India. Comes in contact with Trade winds (North-Westerly).



Winter Monsoon: Surface Winds

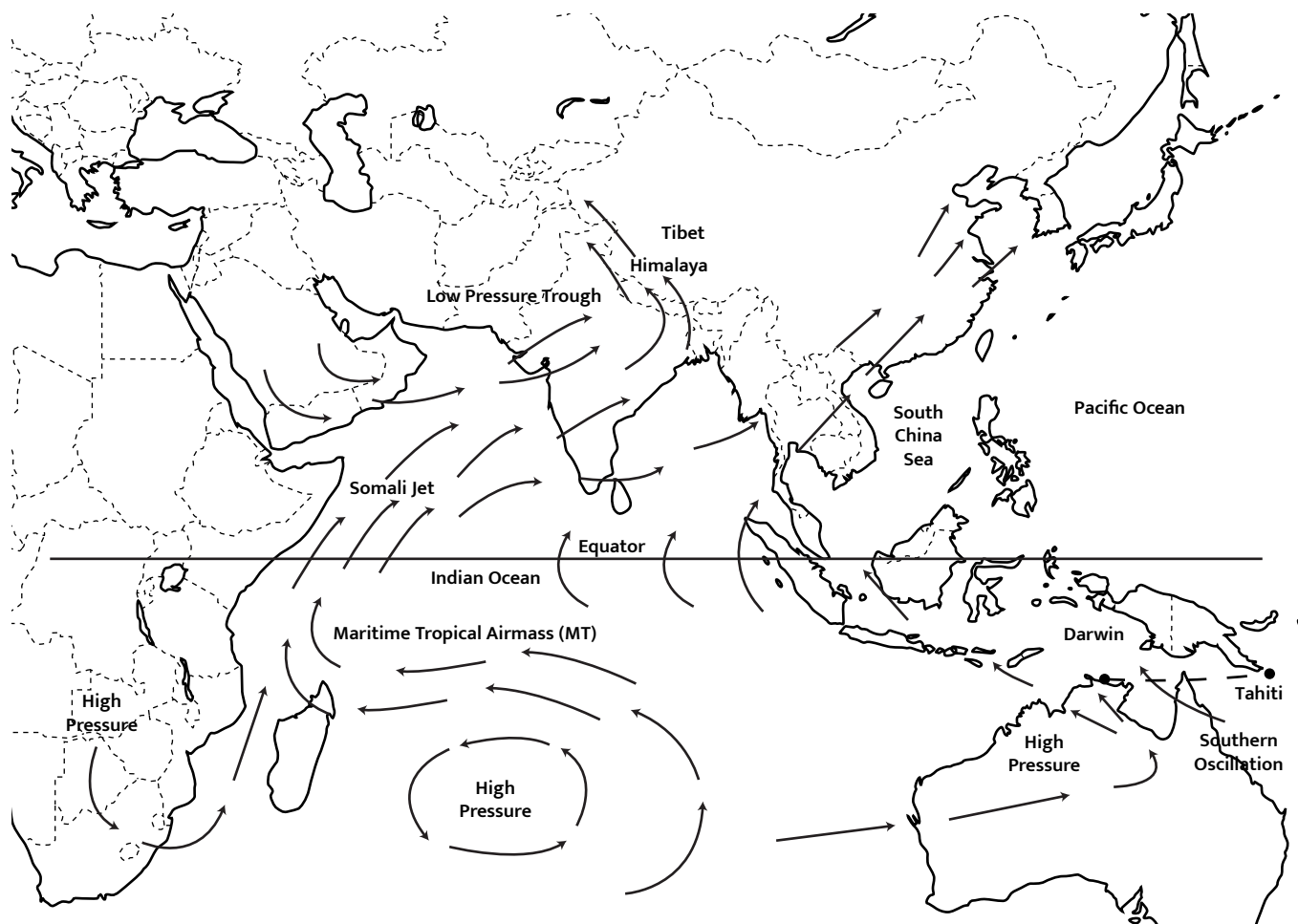


SUMMER



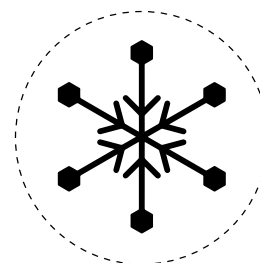
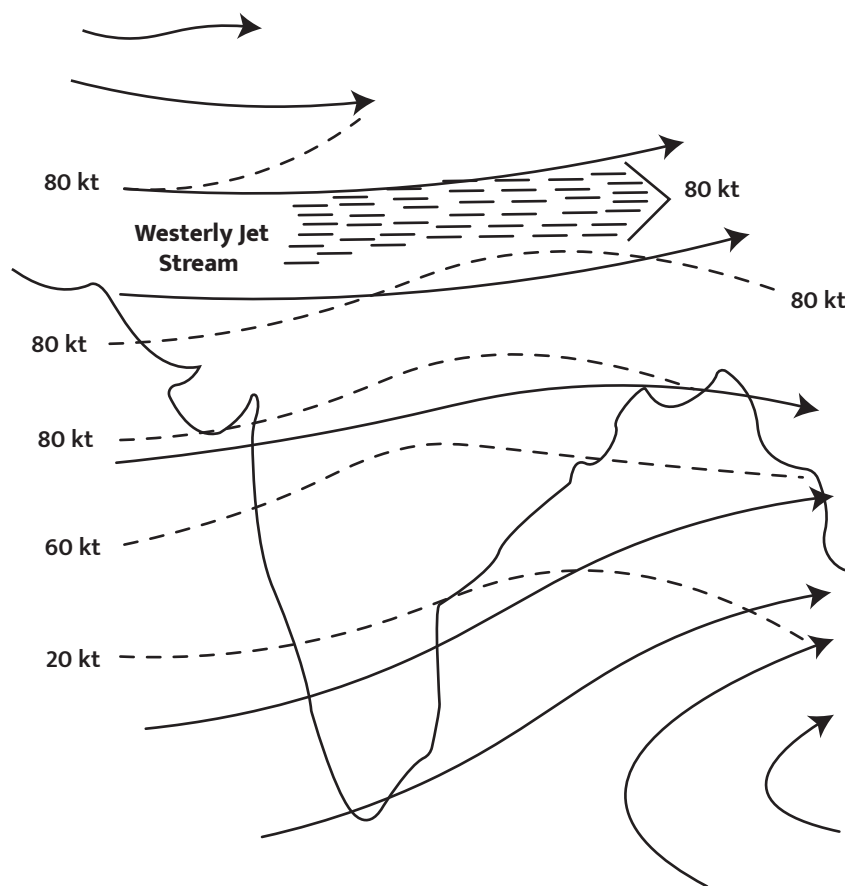
POSITION OF INTER-TROPICAL ZONE (ITCZ) IN THE MONTH OF JANUARY AND JULY

Northward shift of ITCZ. (Low Pressure). Maritime Tropical (mT) airmass crosses equator between 40 degrees E to 60 degrees E longitude (South-West Monsoon).

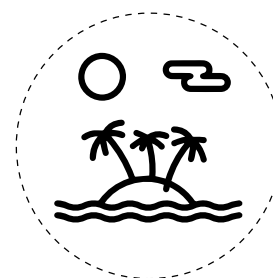
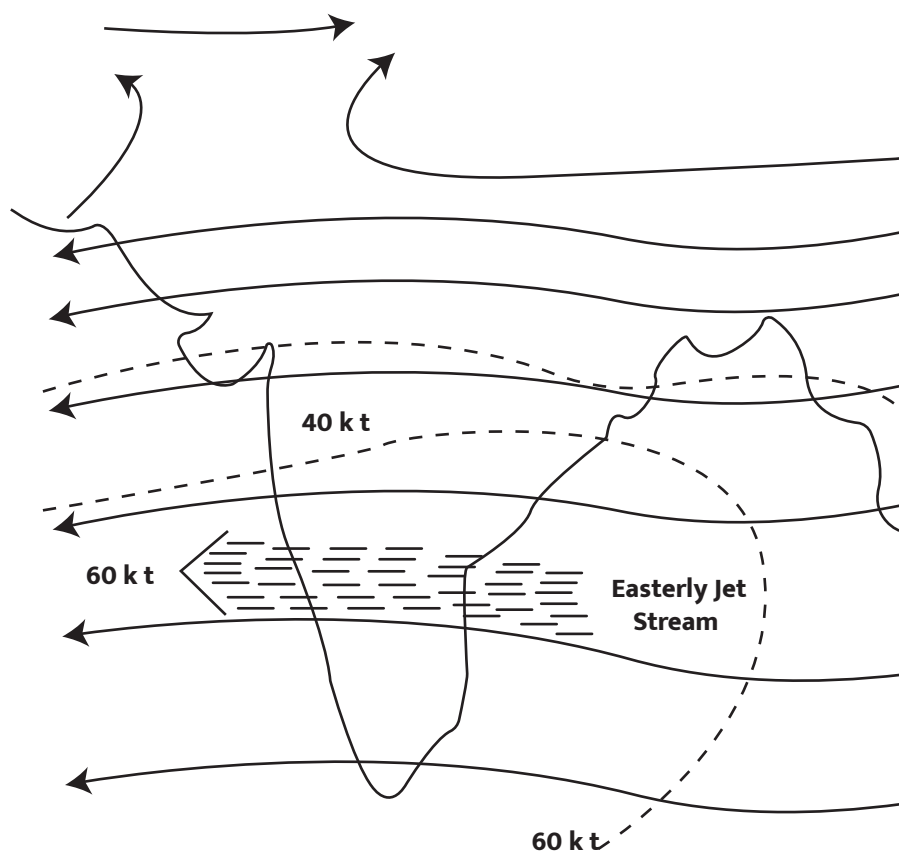


Summer monsoon winds: Surface circulation

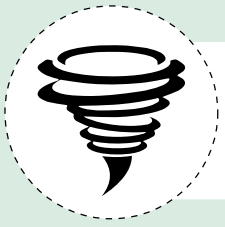
JET STREAM AND UPPER AIR CIRCULATION: WINTER VS SUMMER



Direction of Winds in
India in Winter at the
Height of 9-13 km



The Direction of Winds
at upper atmosphere in
summer season



WESTERN CYCLONIC DISTURBANCES AND TROPICAL CYCLONE

▪ WINTER



Western Cyclonic disturbances which originate in Mediterranean are brought to West and North-West India by Westerly Jet Stream. Tropical cyclones originating over Bay of Bengal hit Tamil Nadu, Andhra and Odisha coast.

▪ SUMMER



The easterly jet stream steers the tropical depressions into India. Track of these depressions are the areas of highest rainfall in India.



FACTORS RELATED TO LOCATION AND RELIEF

1. **Latitude:** Tropic of Cancer-

North of it (Sub-tropical and Temperate zone) Extreme Climate observed, South of it (tropical zone) temperature remains High through out the year.

2. **Himalaya:** Acts as Climatic Divide.

Obstruct the cold and chilly wind originating from Arctic.

3. **Distribution of Land and Water:**

Differential heating creates different air pressure zones in different seasons.

4. **Distance from the Sea:** Interior areas far away from sea experience extreme climates.

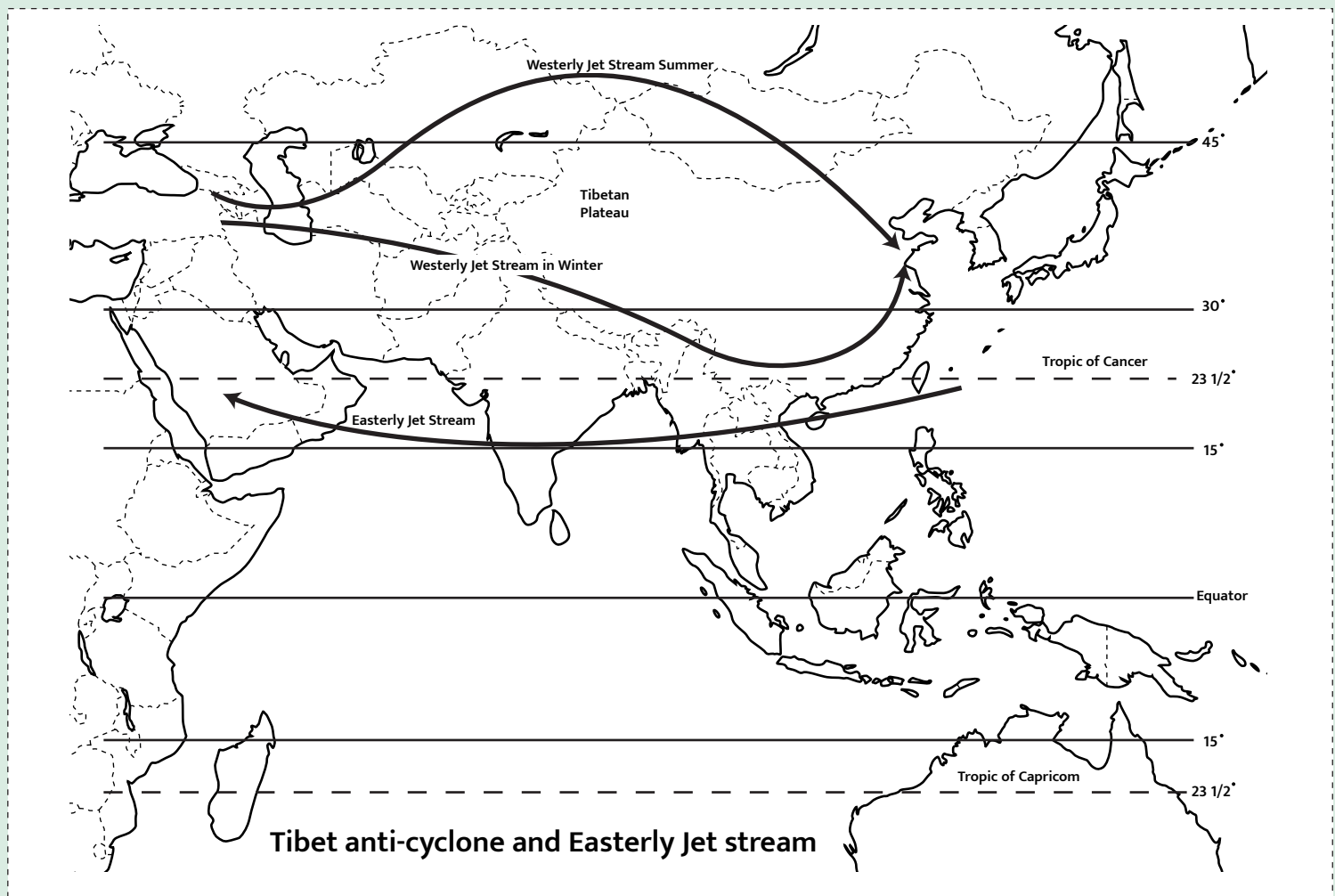
5. **Altitude:** Mountain regions are cooler than plains.

6. **Relief:** Physiography impacts temperature, air pressure, direction and speed of wind and amount and distribution of rainfall.

Example: Windward side of Western Ghats receive higher rainfall whereas Southern Plateau on the leeward side of Western Ghats remain dry.

ORIGIN OF INDIAN MONSOON: FACTORS RESPONSIBLE

■ Role of Himalayas and Tibetan Plateau



Due to its height, the area receives more insolation leading to clock wise circulation in the middle troposphere and emergence of two wind-streams i.e. Tropical Easterly Jet Stream and Westerly Jet Stream.

■ Role of Jet Streams

The Tropical Easterly Jet streams sometimes reaches at the tip of Indian peninsula. This jet descends over the Indian Ocean and intensifies its high pressure cell known as Mascarene High. Hence, onshore winds start blowing towards the thermally induced low pressure area, developed in the northern part of the Indian subcontinent.

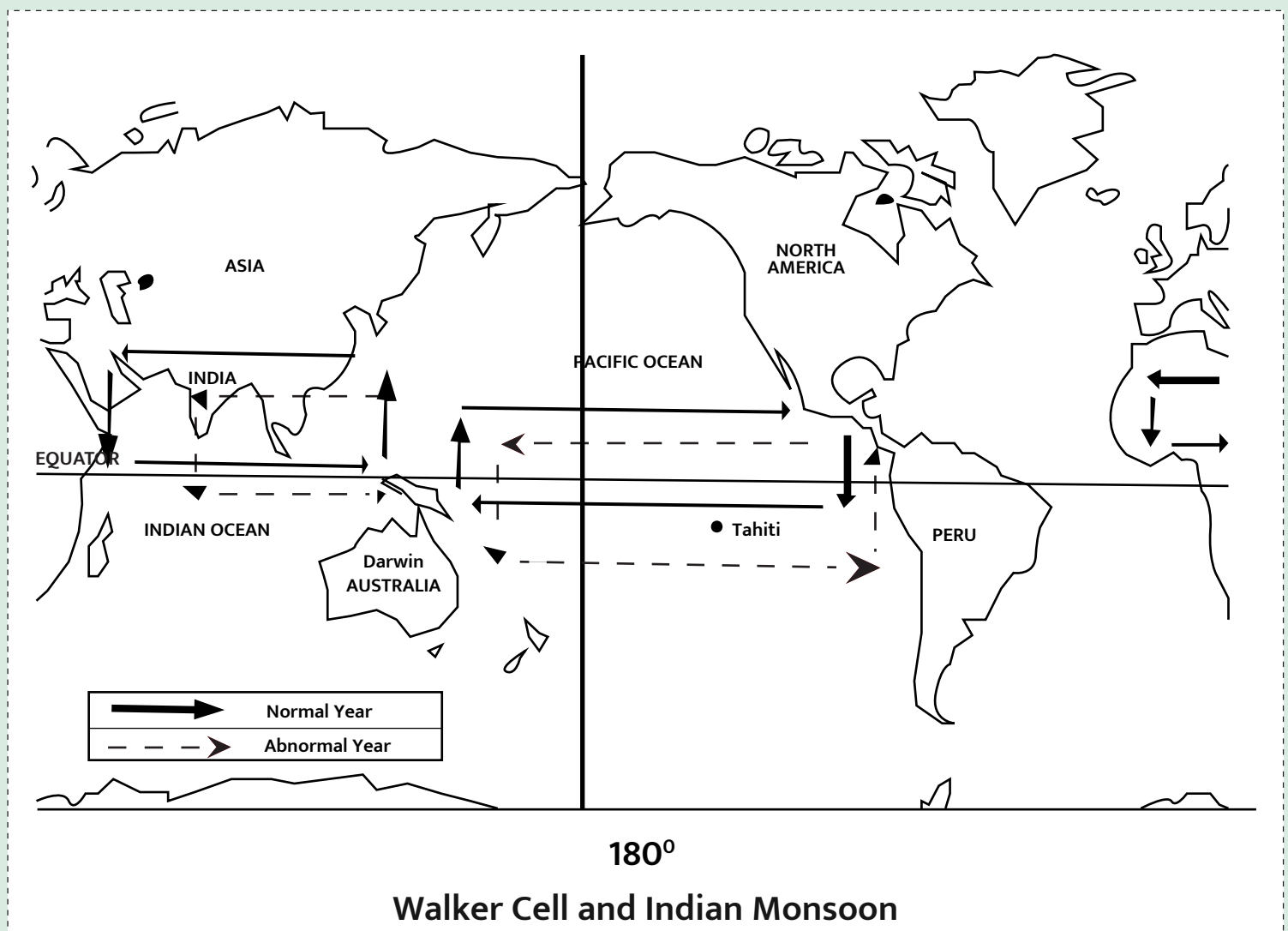
■ Role of ENSO

-El-Nino- Associated with poor monsoon

-Southern Oscillation-A negative SOI (Pressure between Tahiti and Darwin) implies poor monsoon. -Somalian Current-Every 6-7 years the low Pressure area in Western Arabian Sea becomes High Pressure leading to weaker monsoon in India.

■ Role of Walker Cell

El-Nino or Negative SOI-Ascending branch of walker cell shifts towards central regions of the Pacific Ocean. As a result, Indian Ocean Cell shifts towards East. S-W monsoon winds weaken. La-Nina Years: Indian Ocean branch of Walker Cell strengthens. Intense monsoon winds.



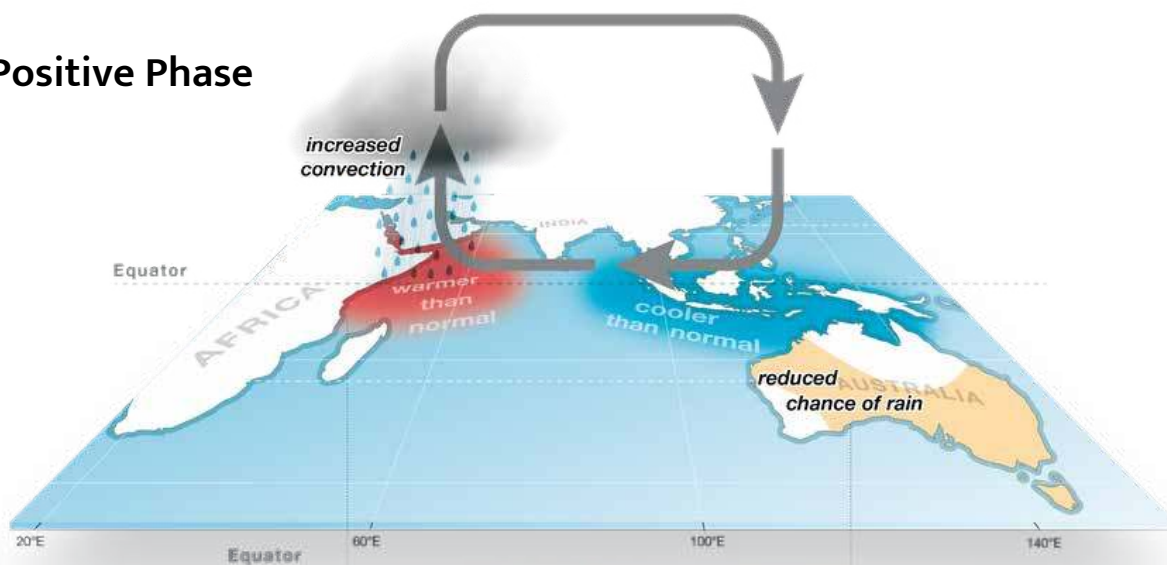
■ Role of Indian Ocean Dipole

(Difference in Sea surface temperature between West and East Indian Ocean).
Positive Phase: Good precipitation in Western region. Draught conditions in Indonesia and Australia. Negative Phase: Warmer water and greater precipitation in the East Indian Ocean.

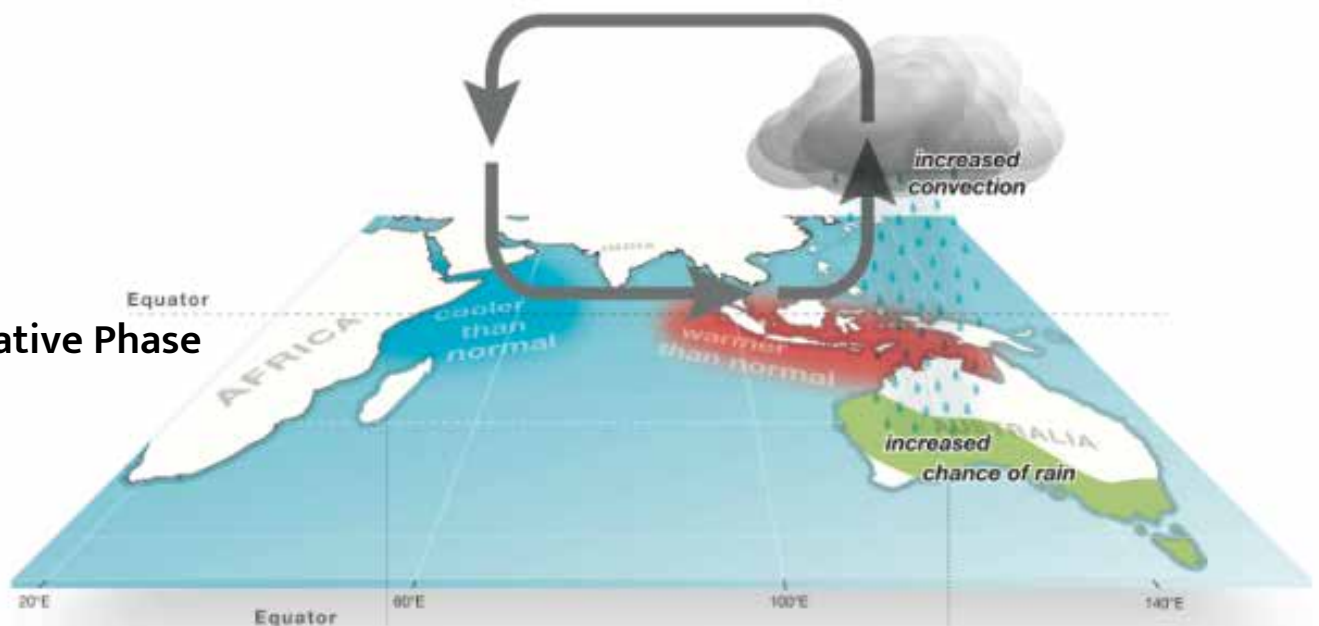
Positive IOD is favorable for India.

INDIAN OCEAN DIPOLE

Positive Phase



Negative Phase

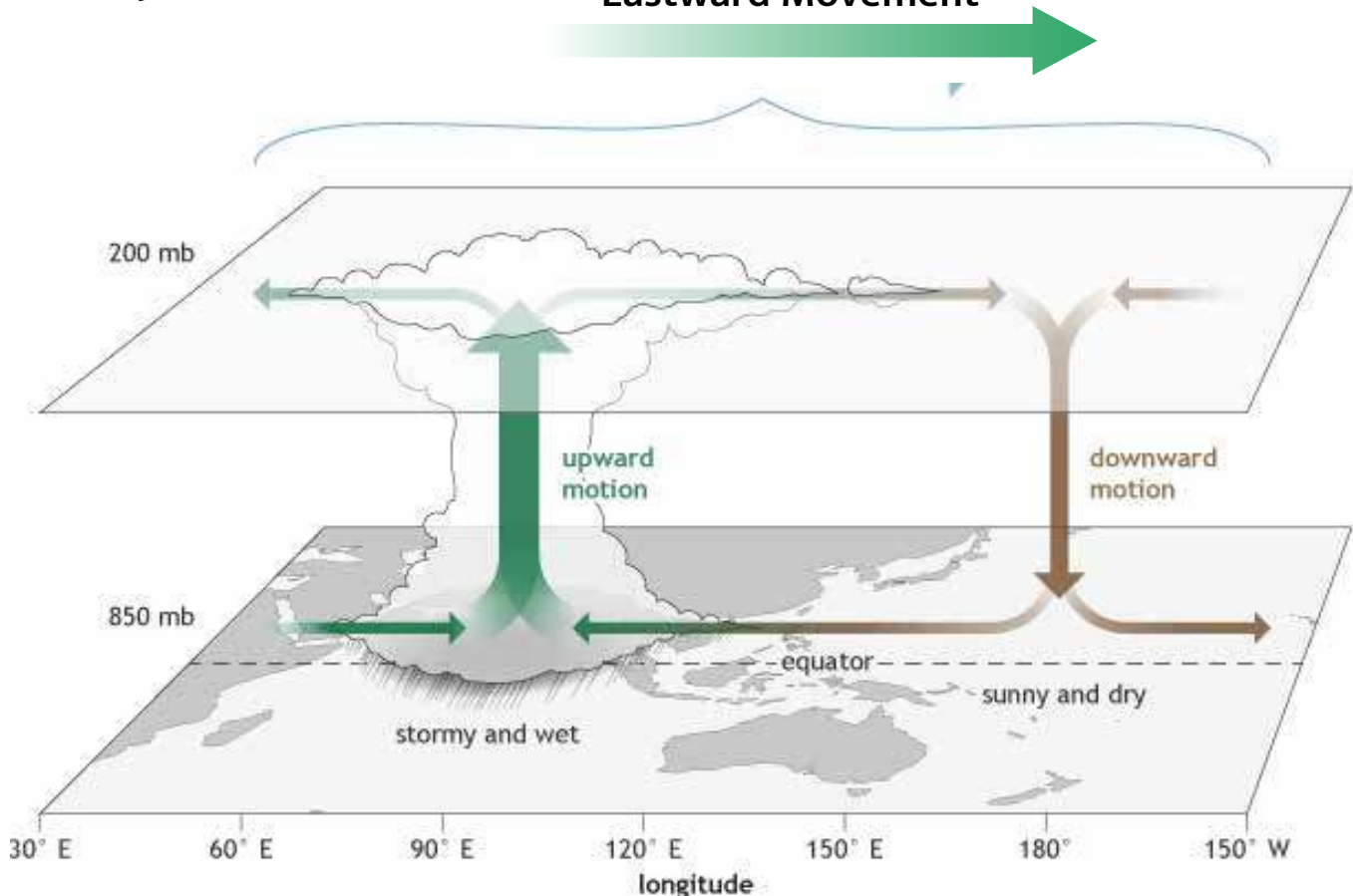


■ Role of Madden-Julian Oscillation

The MJO can be characterized as an eastward moving 'pulse' of cloud and rainfall near the equator that typically recurs every 30 to 60 days. When it is over Indian Ocean during monsoon season, it brings good rainfall. In its longer cycle, when it stays over Pacific Ocean, India receives a weaker monsoon.

Madden-Julian Oscillation

Eastward Movement



NATURE OF INDIAN MONSOON

Onset and Advance of Monsoon

- Low pressure at ITCZ (over north India) becomes so intense in May that it pulls the trade winds of the southern hemisphere northwards. ITCZ shifts Northward and an Easterly Jet Stream develops.
- The southeast trade winds cross the equator (become S-W monsoon winds) take moisture from the equatorial warm currents and enter the Bay of Bengal and the Arabian Sea.

- This sudden onset of the moisture-laden winds associated with violent thunder and lightning, is often termed as the “break” or “burst” of the monsoons.
- Southwest monsoon first of all reaches in Andaman-Nicobar Islands on 15th May. Kerala coast receives it on 1st June. It reaches Mumbai and Kolkata between 10th and 13th June. By 15th of July, Southwest monsoon covers whole of India

Rain Bearing Systems and Distribution of Rainfall

- Two branches: Arabian Sea branch (rainfall over West Coast) and Bay of Bengal Branch (rainfall over plains of North India).
- Arabian sea branch is three times stronger than Bay of Bengal branch and extends till Thar desert.
- Arabian Sea Branch: Splits up into 3 more branches. First branch obstructed by Western Ghats gives Orographic rainfall in the windward side and causes rain shadow area in the Eastern side of Western Ghats. Second branch hits Mumbai coast and along Narmada and Tapi covers Central India. They enter Ganga plain and mingles with Bay of Bengal Branch. A third branch strikes Saurashtra peninsula and Kutch.
- Bay of Bengal branch: Strikes the coast of Myanmar and gets deflected towards Indian subcontinent by Arakan Hills. Hence it enters West Bengal and Bangladesh from south and south-easterly direction and not South-West. The branch splits into two.
 - One branch moves westward towards Ganga plains.
 - Second branch moves towards Brahmaputra valley in the North and North-East
- The Tamil Nadu coast lies in rain shadow area of Arabian Sea branch of the south-west monsoon and lies parallel to the Bay of Bengal branch of south-west monsoon. Therefore, it is dry during monsoon.

Break in the Monsoon: Dry spells during south-west monsoon period

- In northern India rains are likely to fail if the rain-bearing storms are not very frequent along the monsoon trough or the ITCZ over this region.
- Over the west coast the dry spells are associated with days when winds blow parallel to the coast.

Retreat of Monsoon

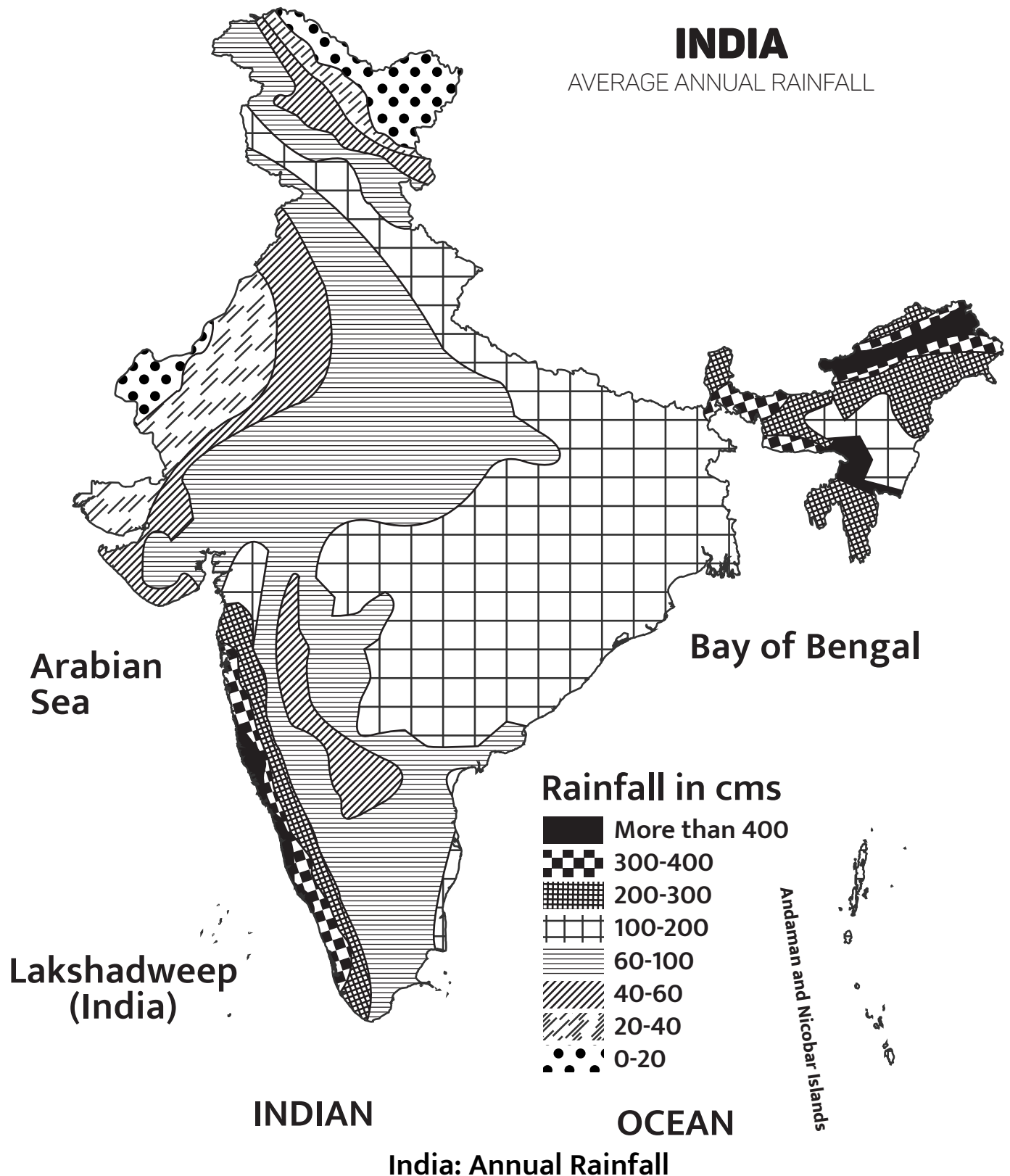
- Monsoon starts retreating in September. On the first of September it starts retreating from north-western part of India. This day is the last day of rainy season in Jaisalmer and Barmer in Rajasthan. By 15th September, monsoon leaves Punjab, Haryana, Rajasthan and Gujarat.
- The area under the monsoon influence shrinks slowly and the monsoon retreats from all parts of India except the southern peninsular region.
- Monsoon winds in most parts of the country are replaced by the north-easterly trade winds. These winds blowing over the Bay of Bengal pick up moisture from there and cause rainfall in Tamil Nadu.

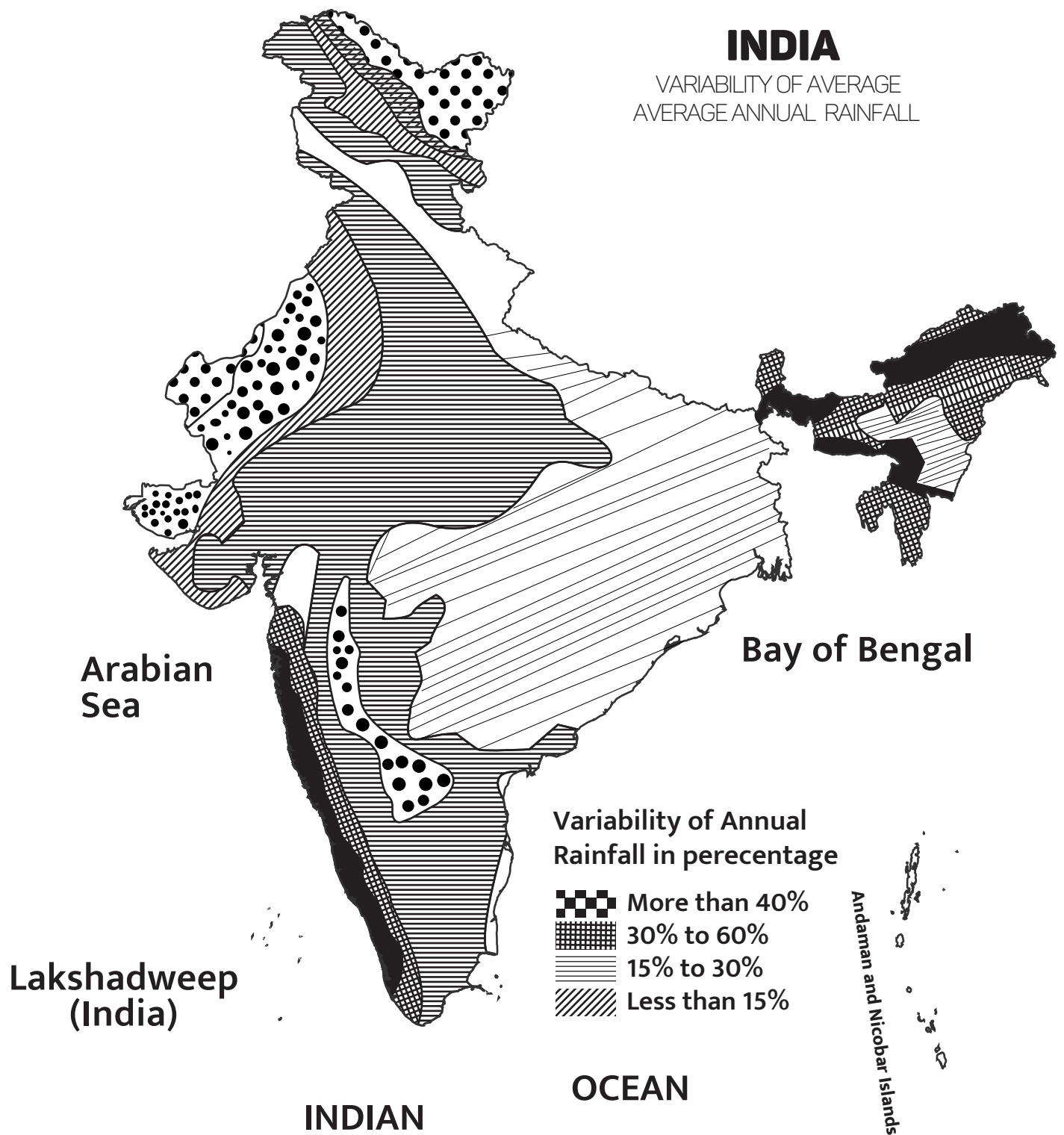
FEATURES OF MONSOON RAIN

- Seasonal in character, occurs between June and September.
- Spatial distribution of rainfall is largely governed by relief or topography.
- The monsoon rainfall has a declining trend with increasing distance from the sea. Rainfall decreases from east to west in plains as one branch of monsoon enters from eastern side.
- The rain displays a declining trend from west to east over the west coast, and from the southeast towards the northwest over the North Indian Plain and the northern part of the Peninsula.
- Rajasthan desert receives low rainfall because Arabian Sea branch blows parallel to Aravalis mountain chain without obstruction and thus, does not release moisture here.

- Breaks in rainfall are related to the cyclonic depressions mainly formed at the head of the Bay of Bengal, and their crossing into the mainland. Besides the frequency and intensity of these depressions, the passage followed by them determines the spatial distribution of rainfall.

DISTRIBUTION AND VARIABILITY OF RAINFALL IN INDIA

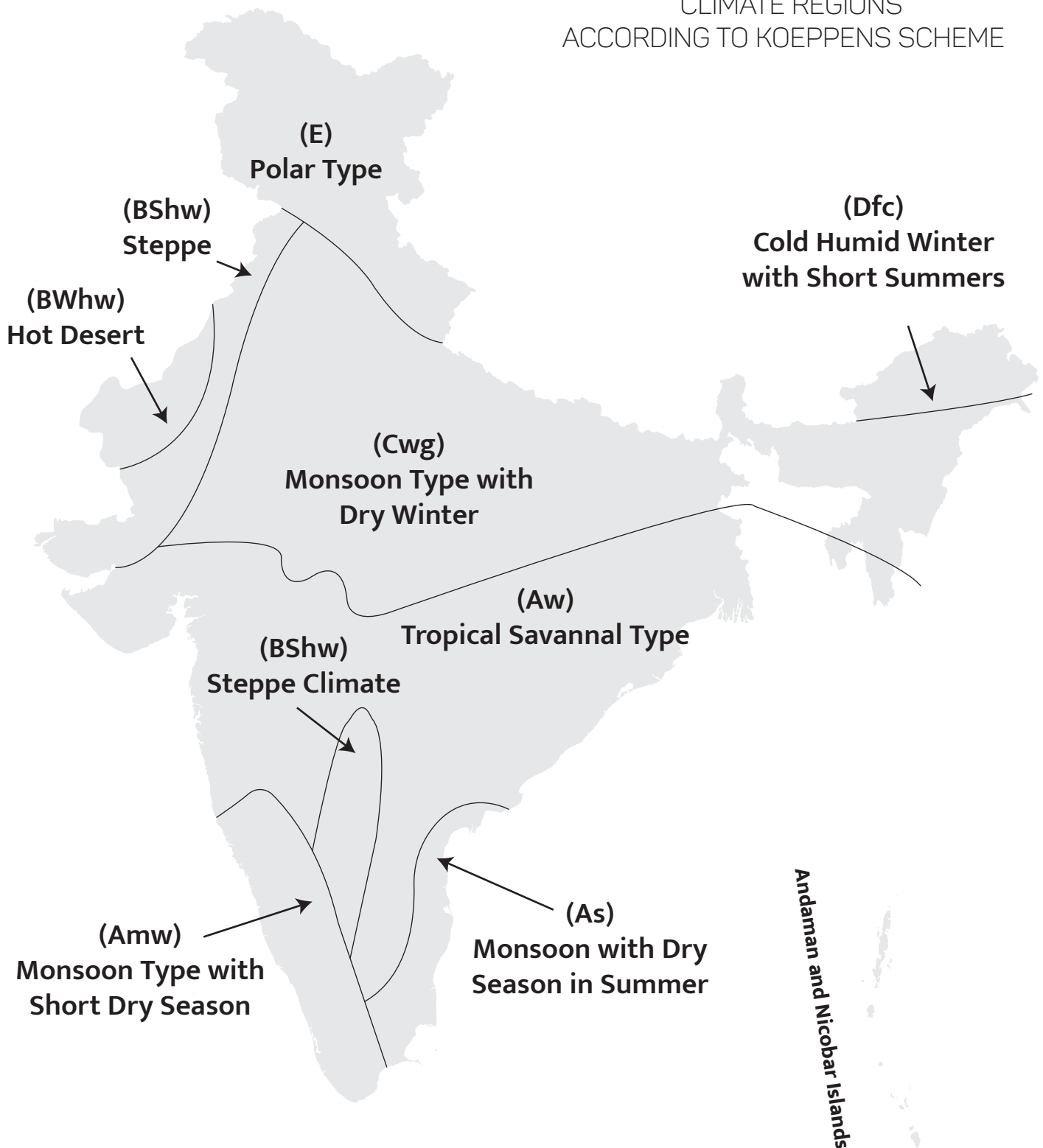




India: Variability of Annual Rainfall

CLIMATIC REGIONS OF INDIA

INDIA CLIMATE REGIONS ACCORDING TO KOEPPENS SCHEME



India: Climatic Regions According to Koeppen Scheme



1. Western Himalayan Region

2. Eastern Himalayan Region

3. Lower Gangetic Plains Region

4. Middle Gangetic Plains Region

5. Upper Gangetic Plains Region

6. Trans-Gangetic Plains Region

7. Eastern Plateau & Hills Region

8. Central Plateau & Hills Region

9. Western Plateau & Hills Region

10. Southern Plateau & Hills Region

11. East Coast Plains & Hills Region

12. West Coast Plains & Ghats Region










13. Gujarat Plains & Hills Region

14. Western Dry Region

15. The Islands Region

INDIAN SEASONS



 Season	 Months According To Indian Calendar	 Months According To English Calendar
 Vasanta	Chaita-Vaisakha	March-April
 Grishma	Jyaistha-Asadha	May-June
 Varsha	Sravana-Bhadra	July-August
 Sharada	Asvina-Kartika	September-October
 Hemanta	Margashirsa-Pausa	November-December
 Shishira	Magha-Phalguna	January-February





DIFFERENT SEASONS OF INDIA WITH THEIR CHARACTERISTICS

SEASON



- Winter Season

DURATION



- Mid- November to February

GENERAL CHARACTERISTICS



- Clear skies, fine weather, low humidity

TEMPERATURE



- Mean daily temperature below 21°C in North India. Some part experience Temperature below freezing point. Temperature increases from north to south.

WIND DISTURBANCES



- High pressure over north- western India. Winds blow from north west to south - east. Around four or five westerly disturbances are carried by westerly jet stream.

RAINFALL



- Westerly disturbances cause rainfall in northern plains. Rainfall decreases from west to east in plains but increases in north-east again as it catch water from Bay of Bangal. North- eastmonsoon causes winter rainfall in southern Andhra Pradesh, Tamil Nadu etc.



SEASON



- Summer Season

DURATION



- April, May, June

GENERAL CHARACTERISTICS



- Excessive heat, hot loo, dust storms and dryness

TEMPERATURE



- Temperature rises up to 45°C in north India.. Temperature has increased to 50°C in Ganganagar earlier. Summer in south India is not so extreme.

WIND DISTURBANCES



- Low pressure over north- western part of India and high pressure over southern parts of Bay of Bengal. ITCZ shifts to Ganges plain. Wind direction Varies from one part of India to the other. Dust storms are frequency experienced in the afternoon in northern plains.

RAINFALL



- Completely dry season. Dust storms and thunder storms provide some rainfall. Eastern regions receive more rainfall comparatively.



SEASON



- South- West monsoon

DURATION



- June- September

GENERAL CHARACTERISTICS



- Whole of India under south- west monsoon. India faces severe cyclone thunderstorms etc.

TEMPERATURE



- June is the hottest month. Temperature remains low during July and August which rises high in September with decreasing amount of precipitation.

WIND DISTURBANCES



- Winds are south- westerly over mainland India.

RAINFALL



- India receives its 80% precipitation in this season. There is decline of rainfall From east to west in plains. Details are disussed under 'Monsoon' Above.